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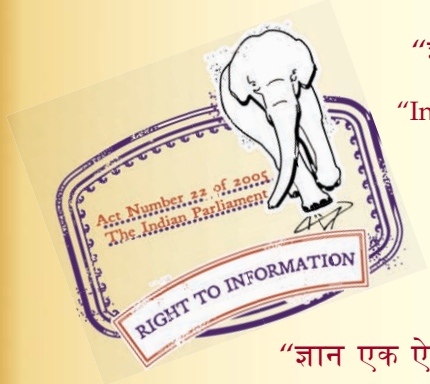

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GLOSSARY OF TERMS FOR I.C. ENGINES

PART I FUEL INJECTION EQUIPMENT

[Internal Combustion Engines Sectional Committee, EDC 14; Fuel Injection Equipment Subcommittee, EDC 14:4 [Ref : Doc : EDC 14 (1936)]

1. Scope — Defines the terms most commonly used in conjunction with fuel injection equipment.

2. Fuel Injection System

2.1 *Fuel Injection Pumps*

2.1.1 *Injection pump* — A device which delivers a metered quantity of pressurized fuel to the combustion chamber of an engine through an injector at the appropriate time.

2.1.1.1 *Pump without integral drive* — A fuel injection pump whose actuating mechanism does not form an integral part of the injection pump; but of the engine. This type of injection pump is primarily of single cylinder type.

2.1.1.2 *Pump with integral drive* — A fuel injection pump whose actuating mechanism is an integral part of the injection pump itself, that is, the actuating mechanism is enclosed in the same housing together with the other parts of the injection mechanism.

2.1.2 *Distributor pump* — A single plunger fuel injection pump in which the plunger has both reciprocating and rotary motion and distributes the fuel to all the fuel outlets of the pump.

2.1.3 *Mounting for pumps with integral drive* — Based on the type of mounting arrangement, the fuel injection pump is grouped into two categories:

a) *Base mounted pump* — A pump which is mounted on the surface of the engine which is parallel to the pump's camshaft axis, and

b) *Flange mounted pump* — A pump which is mounted on the surface of the engine which is at right angles to the pump's camshaft axis. (A shank mounted pump is a specific case of a flange mounted pump with the pump camshaft at right angles to the engine camshaft.)

2.1.4 *Fuel supply (feed) pump* — A pump for drawing the fuel from the fuel tank and supplying it to the fuel injection pump at a positive pressure.

2.1.4.1 *Hand priming device* — An integral unit of the fuel supply (feed) pump used for drawing fuel from the fuel tank and supplying it to the fuel injection pump when the engine is at rest for the purpose of priming.

2.1.5 *Injection pump assembly* — A complete assembly consisting of the fuel injection pump together with additional accessories, such as governor, fuel supply pump and other optional devices, when they are assembled to the fuel injection pump to form a complete unit.

2.1.6 *Pressure time injection system* — A device for metering and injecting the fuel separately. The metered fuel is forced through the spray holes into the combustion chamber by injector plug. The fuel metered through an orifice depends on the fuel pressure and absolute time. The pump used in this system is termed as *pressure time pump.*

2.1.7 *Pump rotation*

a) *Clockwise* — The injection pump camshaft or drive shaft rotates clockwise when viewed from the injection pump drive end.

b) *Counter-clockwise* — The injection pump camshaft or drive shaft rotates counter-clockwise when viewed from the injection pump drive end.

2.1.8 *Element* — The combination of a plunger and its barrel, the two together, form the injecting element of the fuel injection pump. The element may also perform the additional functions of timing and metering.

Note — The assembly of a pump plunger and barrel is matched with extreme accuracy of fit. Hence the assembly forms a unit by itself.

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2.1.9 *Helix* — A term used to describe the control edge of a spill groove provided on the pump plunger, usually of helical form. The helices may be upper or lower or both and may be the same hand or opposite. They can also be duplicated on both sides of the plungers.

2.1.10 *Hand of helix* — If by turning the plunger towards left (viewed from plunger foot towards the control edge) increased fuel delivery is obtained, the helix is termed *left hand*. If, the increased fuel delivery is obtained by turning the plunger towards right, the helix is termed *right hand*.

2.1.11 *Helix lead* — The axial advance of the helix edge in one revolution.

2.1.12 *Port and helix metering* — A system of metering fuel quantity by means of one or more helical cuts in the plunger and one or more ports in the barrel. Axial rotation of the plunger alters the effective portion of the stroke by changing the points at which the helix or helices cover or uncover the port or ports.

2.1.13 *Inlet metering* — A system of metering fuel quantity by controlling the amount of fuel entering the pumping chamber of the barrel during the filling or suction stroke of the plunger.

2.1.14 *Sleeve metering* — A system of metering fuel quantity incorporating a movable sleeve with which port opening and/or port closing is controlled.

2.1.15 *Port closing* (*commencement of delivery*) — The point at which the plunger closes the spill port (provided on the barrel) such that the entry of the fuel through the suction port stops.

2.1.16 *Port opening* (*end of delivery*) — A term referring to the method of determining the point of end of delivery where the metering of injected quantity is effected by means of port on barrel and helix on the plunger. The point of end of delivery is that when a point of the helix of the plunger uncovers the port of the barrel.

2.1.17 *Commencement of injection* — The point at which the fuel is injected out of the nozzle in an atomized form into the combustion chamber of the engine.

2.1.18 *Pre-stroke* — The pre-stroke is that part of the stroke that has been utilized by the plunger during its upward (delivery stroke) movement, from bottom dead centre, till the top face of the plunger covers the inlet (spill) port of the barrel.

2.1.19 *Spill* — The fuel returning from the pressure chamber of the element to the pump suction chamber, during the upward stroke of the plunger.

2.1.20 *Spill groove* — A groove provided in the plunger below the control edge, which leads the spill to flow from the element pressure chamber back into the pump suction chamber.

2.1.21 *Spill port* — The port provided on the element barrel which allows the fuel, from the pressure chamber of the element barrel, to return to the pump suction chamber to cause the end of injection.

2.1.22 *Spill valve* — A valve used to observe commencement and end of delivery during the delivery stroke of the plunger by allowing the fuel to escape from the pumping chamber.

2.1.23 *Delivery valve assembly* — A valve assembly installed in an injection pump, interposed between the pumping chamber (plunger and barrel assembly) and outlet, to control residual pressure in fuel delivery pipes. This assembly is also known as ' anti-dribble device '.

2.1.24 *Retraction (unloading/relief) volume* — The volume of fuel retracted (relieved) from the fuel delivery pipe by the action of the delivery valve's retraction piston (relief piston/relief plunger) in the process of the delivery valve returning to its seat following the end of delivery.

2.1.25 *Delivery valve holder* — A holder which retains the delivery valve assembly within the injection pump. This also forms the outlet of the injection pump.

2.1.26 *Fuel injection pump housing* — The main casing into and to which are assembled all the components and other optional devices associated with the fuel injection pump.

2.1.27 *Control rack* — The rack or rod by means of which the fuel quantity delivered is regulated.

2.1.28 *Control pinion (control sleeve or regulating sleeve)* — A collar engaging the plunger and having a segment of gear teeth, integral or attached, which mesh with the control rack. With this, the linear motion of the control rack is transformed into rotary movement of the plunger to regulate the amount of fuel delivered by the pump.

2.1.29 *Rack control lever* — A lever attached to a collar or sleeve engaging the plunger, or attached

directly to the plunger, its other end engaging adjustable fittings on the control rod. This transforms the linear motion of control rod into rotary motion of plunger to regulate the amount of fuel delivered by the pump.

2.1.30 *Full load stop (maximum speed control)* — A device which limits the travel of the control rack.

2.1.31 *Excess fuel device* — Any device provided for giving an increased fuel setting for starting only, generally designed to restore automatically action of the normal full load stop after starting.

2.1.32 *High pressure fuel pipe* — The pipe connecting the fuel injection pump and the nozzle holder assembly.

2.2 *Governor*

2.2.1 *Governors classified by principle of operation*

2.2.1.1 *Mechanical governor* — A mechanical device that utilizes variation of centrifugal force with speed to regulate the quantity of fuel delivered to the engine by the fuel pump.

2.2.1.2 *Hydraulic governor* — A mechanical governor having a hydraulic servo-booster to increase output for force.

2.2.1.3 *Pneumatic governor*

a) *Vacuum or suction governor* — A governor which works on a difference of pressure between the suction chamber and the atmospheric chamber.

b) *Air governor* — A governor operated by air displaced by a device provided for this particular purpose and driven by the engine.

2.2.1.4 *Load sensitive governor* — An engine speed regulating device for use on engine generator sets to regulate engine fuel settings as a function of changed loads (electrical load) anticipating the resulting changes in engine speed. It may or may not incorporate a mechanical speed sensing device as well.

2.2.2 *Governors classified by function*

2.2.2.1 *Variable speed governor* — Any one of the governors classified under **2.2.1** which regulates the fuel quantity delivered by the injection pump throughout the speed range of the engine.

2.2.2.2 *Maximum-minimum speed governor* — Any one of the governors classified under **2.2.1** which exert control only at the upper and lower limits of the designed engine speed range; intermediate speeds being controlled by the operator regulating the fuel delivery.

2.2.2.3 *Over speed governor (maximum speed governor)* — A mechanical speed-sensitive device that, through mechanical or electrical action (operation of a switch), acts to shut down the engine by cutting off fuel or air or both fuel and air supply should the engine speed exceed a preset maximum.

2.2.2.4 *Tail shaft governor* — A mechanical speed-sensitive device commonly mounted on an engine-driven torque converter to monitor its tail-shaft speed. It is mechanically connected to the normal engine governor such that engine output will be governed to maintain a constant tail-shaft speed regardless of torque load.

2.2.3 *Sensitivity of the governor* — The difference in speed achieved and the rated speed at the time when the engine is relieved of its load suddenly while the engine is operating under full load and at rated speed before the governor could exercise control over the engine. This is normally expressed as a relation between the average maximum speed between full load and no load. This is also a measure for the efficiency of the governor.

2.2.4 *Torque control (adaption)* — A device which adopts the maximum fuel delivered by the injection pump to the needs of speed and load, at speeds below the engine rated speed.

2.3 *Injection Timing Device* — A device responsive to engine speed or load or both speed and load to control the timed relationship between injection cycle and engine cycle.

2.4 *Injector Assembly* — The nozzle and nozzle holder assembly where by the fuel metered by the fuel injection pump is introduced into the combustion chamber.

2.4.1 *Nozzle* — The assembly of parts employed to atomize and to introduce the fuel into the combustion chamber in the desired pattern both with regard to space and time.

2.4.2 *Nozzle holder* — The assembly of all parts of the nozzle holder assembly other than those comprising the nozzle.

2.4.3 *Open nozzle* — A nozzle incorporating no valve.

2.4.4 *Closed nozzle* — A nozzle incorporating either a poppet valve or a differential needle valve, loaded with spring, in order to open at some predetermined pressure.

2.4.4.1 *Poppet valve* — An outwardly opening valve used with certain forms of closed nozzles.

2.4.4.2 *Differential needle valve* — Refers to that portion of the nozzle needle of a closed nozzle where the pressure taper and needle seat are formed. The differential needle valve has two diameters, the smaller being at the valve seat. At this point of the valve (needle) the pressure of the injected fuel acts and lifts the valve (needle) off its seat at the predetermined pressure (spring pressure) to permit the fuel to be introduced into the combustion chamber.

2.4.4.3 *Pintle nozzle* — A closed nozzle with the differential needle valve with a single large orifice (spray hole) at the bottom face of the nozzle body, into which enters a projection from the lower end of the differential (needle) valve; this projection being so shaped as to influence the nature and direction of the fuel spray.

2.4.4.4 *Hole nozzle* — A closed nozzle with the differential needle valve with one or more orifices (spray holes) through which the fuel spray emerges out. Nozzles with more than one orifice are known as multihole nozzles. The orifices are formed on the nozzle (body) tip.

2.4.4.5 *Pintaux nozzle* — A differential nozzle incorporating the characteristics of both the pintle and hole nozzles designed primarily to improve cold starting of precombustion chamber engines, without the use of heater (glow) plugs.

2.4.5 *Nozzle body* — The part of the nozzle which serves as a guide for the valve (nozzle needle) and in which the actual spray holes are formed. These two parts, the body and the needle are considered as a unit for replacement purposes.

2.4.6 *Nozzle tip* — The extreme end of the nozzle body containing the spray hole. It may be a separate part.

2.4.7 *Nozzle holder cap nut* — A cap nut or other type of closure which covers the outer end of the nozzle holder.

2.4.8 *Nozzle retaining nut* — That part of the nozzle holder which secures nozzle or nozzle tip to the other nozzle holder parts.

2.4.9 *Pressure spindle (pressure bolt)* — A spindle that transmits the load from the spring to the valve (nozzle needle).

2.4.10 *Pressure adjusting screw or shims* — The screw or shims by means of which the spring pressure on the nozzle valve (needle) is adjusted to obtain the prescribed opening pressure.

2.4.11 *Spring retainer* — It supports the spring and carries the adjusting screw or shims.

2.4.12 *Nozzle holder shaft length* — The distance from the top of the cylindrical shaft to the seating face of the nozzle holder.

2.4.13 *Nozzle holder seating face* — The face upon which nozzle holder sits to make a gastight seal with the cylinder head. Commonly this face is incorporated on the nut used for retaining the nozzle to the nozzle holder.

2.4.14 *Edge type bar filter* — A contrivance at the fuel entry to the nozzle holder assembly. The arrangement of a special edge type bar inside this filter, pulverizes the solid particles, by the forces created by fuel thrusts, to such a small size that they cannot cause damages to nozzle components. This is used, primarily along with hole nozzles.

2.4.15 *Diameter ratio* — The ratio between the guide diameter of the needle and the effective diameter of the needle valve seat.

2.4.16 *Spray hole(s)* — The opening or openings at the end of the nozzle body or nozzle tip through which the fuel is sprayed into the combustion chamber.

2.4.17 *Spray dispersal angle* — The included angle of the cone of fuel leaving any single spray hole in the nozzle body or nozzle tip including pintle type.

2.4.18 *Spray angle* — The included angle of the cone embracing the axes of the several spray holes of a multihole nozzle. In the case of nozzles for large engines more than one spray angle may be needed to embrace all the sprays, for example, an inner and an outer spray angle.

2.4.19 *Spray inclination angle* — The angle which the axis of a cone of sprays makes with the axis of the nozzle holder.

2.4.20 *Tip sack* — The recess inside the nozzle body or nozzle tip acting as a feeder to the spray hole(s) in a hole nozzle.

2.4.21 *Differential angle* — The difference between the angles of the seat face of the valve (nozzle needle) and that of the seat in the body provided to ensure effective sealing.

2.4.22 *Leak-off* — Fuel which escapes between the nozzle (needle) valve and its guide. (This term is also used to describe the leakage past the plunger of a fuel pump.)

2.4.23 *Nozzle opening pressure* — The pressure needed to lift the nozzle valve (needle) from its seating.

2.4.24 *Peak injection pressure* — The maximum fuel pressure attained during the injection period.

2.4.25 *Pilot injection* — A small initial charge of fuel delivered to the engine cylinder in advance of the main delivery of fuel.

2.4.26 *Ignition injection* — A small charge of fuel used to ignite the main gas charge in dual fuel engines.

2.4.27 *Secondary injection* — The fuel discharged (lifting of the needle from its seat) from a nozzle as a result of reopening of the nozzle valve after the main discharge.

2.4.28 *Dribble* — Insufficiently atomized fuel emerging out of the nozzle at or immediately following the end of a main injection.

2.5 *Fuel Injector* — An assembly which receives a metered charge of fuel from another source at a relatively low pressure and then, is actuated by an engine mechanism to inject the charge of fuel to the combustion chamber at high pressure and at the appropriate time.

2.5.1 *Unit fuel injector* — An assembly which receives fuel under supply pressure and is then actuated by an engine mechanism to meter and inject the charge of fuel to the combustion chamber at high pressure and at the appropriate time.

2.5.2 *Delivery valve* — A spring loaded valve which opens at some predetermined pressure to permit fuel flow from the injector plunger and bushing to the spray tip.

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